

AMENDMENT TO THE CLAIMS

19. (Previously presented) A semiconductor device comprising:

an insulating film formed on a semiconductor substrate;

a lower interconnect formed in the insulating film;

a via hole formed on the lower interconnect and in the insulating film;

an interconnect groove formed in an upper region of the via hole and in the insulating film;

a plug composed of a conducting film buried in the via hole;

an upper interconnect buried in the interconnect groove; and

a barrier layer formed between the insulating film and the plug, the insulating film and the upper interconnect, and the plug and the lower interconnect,

wherein the conducting film comprises copper, aluminum or silver,

wherein the barrier layer is composed of a laminated film including a lower first barrier layer and an upper second barrier layer, and

wherein the first barrier layer is made from a tantalum nitride film, and the second barrier layer is made from a tantalum film having a β -crystal structure.

20. (Previously presented) The semiconductor device of Claim 19, wherein the conducting film is a copper film.

21. (Previously presented) The semiconductor device of Claim 20, wherein the copper film is oriented to the (111) plane.

22. (Previously presented) The semiconductor device of Claim 19, wherein a value of (a number of nitrogen atoms)/(a number of tantalum atoms) of the tantalum nitride film is 0.4 or less.

23. (Previously presented) The semiconductor device of Claim 19, wherein the insulating film includes a fluorine component.

24. (Previously presented) The semiconductor device of Claim 19, wherein the second barrier layer is deposited on the first barrier layer.

25. (Previously presented) A semiconductor device comprising:

an insulating film formed on a semiconductor substrate;

a lower interconnect formed in the insulating film;

a first interlayer insulating film formed on the lower interconnect and the insulating film;

a via hole formed on the lower interconnect and in the first interlayer insulating film;

a second interlayer insulating film formed on the first interlayer insulating film;

an interconnect groove formed in an upper region of the via hole and in the second interlayer insulating film;

a barrier layer formed respectively on a bottom and walls of the via hole and the interconnect groove; and

a plug and an upper interconnect composed of a conducting film formed on the barrier layer provided in the via hole and the interconnect groove,

wherein the conducting film comprises copper, aluminum or silver,

wherein the barrier layer is composed of a laminated film including a lower first barrier layer and an upper second barrier layer, and

wherein the first barrier layer is made from a tantalum nitride film, and the second barrier layer is made from a tantalum film having a β -crystal structure.

26. (Previously presented) The semiconductor device of Claim 25, wherein the conducting film is a copper film.

27. (Previously presented) The semiconductor device of Claim 26, wherein the copper film is oriented to the (111) plane.

28. (Previously presented) The semiconductor device of Claim 25, wherein a value of (a number of nitrogen atoms)/(a number of tantalum atoms) of the tantalum nitride film is 0.4 or less.

29. (Previously presented) The semiconductor device of Claim 25, wherein the first interlayer insulating film or the second interlayer insulating film includes a fluorine component.

30. (Previously presented) The semiconductor device of Claim 19, wherein the second barrier layer is deposited on the first barrier layer.

31-36. (Canceled)

37. (New) A semiconductor device, comprising:

an insulating film including a recess formed therein,

a conducting film formed in the recess; and

a laminated film formed between the insulating film and the conducting film,

wherein the conducting film comprises copper, aluminum or silver,

wherein the laminated film includes a lower first barrier layer and an upper

second barrier layer, and

wherein the first barrier layer is made from a tantalum nitride film, and the second barrier layer is made from a tantalum film having a β -crystal structure.

38. (New) The semiconductor device of claim 37, wherein the recess comprises a via hole and an interconnect groove.

39. (New) The semiconductor device of claim 38, further comprising:

a plug formed in the via hole; and

an interconnect formed in the interconnect groove.

40. (New) The semiconductor device of Claim 37, wherein the conducting film includes a copper film.

41. (New) The semiconductor device of Claim 40, wherein the copper film is oriented to the (111) plane.

42. (New) The semiconductor device of Claim 37, wherein a value of (a number of nitrogen atoms)/(a number of tantalum atoms) of the tantalum nitride film is 0.4 or less.

43. (New) The semiconductor device of Claim 37, wherein the insulating film includes a fluorine component.

44. (New) A semiconductor device, comprising:

an insulating film;

a conducting film formed on the insulating film; and

a barrier layer formed between the insulating film and the conducting film,

wherein the barrier layer is made from a tantalum film having a β -crystal structure, and

wherein said barrier layer and conducting film are sequentially deposited so that at least a portion of the barrier layer directly contacts the conducting film after which an annealing step is conducted, and

wherein after the annealing step, said at least a portion of the barrier layer directly contacts the conducting film.

45. (New) The semiconductor device of claim 44, wherein the conducting film comprises copper, aluminum or silver.
46. (New) The semiconductor device of claim 44, wherein the insulating film includes a recess and said conducting film being formed in said recess.
47. (New) The semiconductor device of claim 46, wherein the recess comprises a via hole and an interconnect groove.
48. (New) The semiconductor device of claim 47, further comprising:
- a plug formed in the via hole; and
 - an interconnect formed in the interconnect groove.
49. (New) The semiconductor device of Claim 44, wherein the conducting film includes a copper film.
50. (New) The semiconductor device of Claim 49, wherein the copper film is oriented to the (111) plane.
51. (New) The semiconductor device of Claim 44, wherein the insulating film includes a fluorine component.